USGS science for a changing world

Western Ecological Research Center http://www.werc.usgs.gov

Publication Brief

| Release: | Contacts: | Email: | Phone: |
|---|---|---|---|
| May 2013 | Matt Brooks | mlbrooks@usgs.gov | 559-240-7622 |

USGS Western Ecological Research Center | Yosemite Field Station | 40298 Junction Drive, Suite A, Oakhurst, CA 93644

# Resistance to Invasives and Altered Fire Regimes Differs Between Cold and Hot Desert Shrublands

Settlement by Anglo-Americans in the desert shrublands of North America has resulted in the introduction and subsequent invasion of multiple nonnative invasive grass species. These invasions have altered pre-settlement fire regimes, converted native perennial shrublands to nonnative annual grasslands, and placed many native desert species at risk.

Effective management of desert shrublands relies on a clear understanding of the threats posed by invasive plants and altered fire regimes, mechanism by which they cause undesirable impacts, and management strategies that can prevent or otherwise mitigate their negative effects. An article in *Rangeland Ecology & Management* by Matt Brooks of USGS and Jeanne Chambers of USDA Forest Service provides an overview of key factors, concepts and tools to understand the ecological resistance to biological invasion and resilience to fire of desert shrublands of North America.

**Resistance** and **resilience** differ among the cold and hot desert shrublands of the Great Basin, Mojave, Sonoran, and Chihuahuan deserts. These differences are largely determined by spatial and temporal patterns of productivity, but also are affected by ecological memory, severity and frequency of disturbance, and feedbacks among invasive species and disturbance regimes.

**Resistance to invasion** is a function of the biotic and abiotic factors and ecological processes in an ecosystem that limit the establishment and population growth of an invading species. Resistance is high where net productivity and functional diversity are high, leaving little available for invading plants. Areas with extremely low resource availability and net productivity can also be resistant to invasion. In contrast, extreme fluctuations in resource supply can reduce resistance to invasion.

**Resilience to fire** is related to the amount of disturbance that an ecosystem can withstand before changes in processes and structures occur that are of sufficient magnitude to cross a threshold into new alternative states. Resilience is typically high where available resources, annual net primary productivity, and functional diversity of native plant communities are high.

Strategies for preventing or managing plant invasions and altered fire regimes in desert shrublands include: **1)** conducting periodic regional or site assessments to determine invasion resistance and fire resilience; **2)** developing an understanding of ecological thresholds associated with resistance and resilience that characterize transitions from desirable to undesirable states; and **3)** prioritizing management activities based on resistance of areas to invasion and resilience to fire.

## Management Implications

- Prioritize land management activities at landscape scales in order to restore and maintain ecosystems and to meet conservation objectives.
- Develop ecological site descriptions based on ecological resilience that incorporate process-based indicators and describe triggers, feedback mechanisms, and restoration pathways.
- Develop invasive species management plans specific to the ecosystems of interest and that are based on ecological factors that influence ecological resistance to plant invasions.
- Develop fire management plans that are specific to the ecosystems of interest and that are based on ecological factors that influence ecological resilience to fire.

THIS BRIEF REFERS TO:
Brooks, M.L. and J.C. Chambers. 2011. Resistance to Invasion and Resilience to Fire in Desert Shrublands of North America. Rangeland Ecology & Management 64(5): 431-438. doi: 10.2111/REM-D-09-00165.1

http://www.werc.usgs.gov/ProductDetails.aspx?ID=4900
http://www.werc.usgs.gov/brooks